INSTRUCTION MANUAL

OSCILLOSCOPE CAMERA

TYPE 'A'

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TECHNICAL INFORMATION

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INTRODUCTION

The Telford Type 'A' Camera is a universal model for oscilloscope recording. It is designed to enable permanent records of displayed pheonomena to be obtained under a very wide range of conditions.

Versatility is achieved by the "building block" principle which enables a camera to be assembled by selection from a wide range of lenses, film holders and oscilloscope adaptors. A camera can thus be given a specification to suit a particular requirement, but subsequently modified as other functions are required. Furthermore, a low cost camera can be easily converted into a comprehensive instrument by the purchase of additional parts.

The prime requirement for this camera is with the Polaroid fast processing unit, which enables permanent oscillograms to be produced within 10 seconds from exposure. This back is available either as a single shot unit or in conjunction with a slide plate holder which allows multiple exposure to be obtained.

This slide plate also takes the International Back which accepts the Polaroid 4 x 5 processing holder or cut sheet, plate or roll film backs using conventional negative materials.

All controls are externally accessible to allow easy and rapid adjustment of exposure time and lens aperture setting.

SECTION 1

TECHNICAL SPECIFICATION

1.1 LENS/SHUTTER ASSEMBLIES

All lenses are assembled in pre-focused interchangeable mounts which give a predetermined object/image ratio. The following lenses, which have been especially computed for oscillography, are listed as stock items:-

Dallmeyer 3" f/3.5 Oscillograph in Gauthier IBSOR 0 Shutter, ratios 1:1, 1:0.7 or 1:0.5.

Dallmeyer 3" f/2.8 Oscillograph in Gauthier IBSOR 0 Shutter, ratios 1:1, 1:0.7 or 1:0.5.

Dallmeyer 80 mm. f/1.9 Oscillo-Raptar in IBSOR 1 Shutter.
Ratios 1:1 to 1:0.5.

Dallmeyer 80 mm. f/1.5 Octac in ILEX 4 Synchro Shutter, ratio 1:1. An additional ratio of 1:0.7 is available by the addition of a corrector lens.

Dallmeyer 80 mm. f/1.5 Octac, ratio 1:1 in a rigid iris mount.

All shutters have built in iris controls and have the following speed settings:-

IBSOR 0,) 1/125 to 1 second. Bulb and Time.
IBSOR 1,)

ILEX 4 1/50 to 1 second. Bulb and Time.

The shutters can be fired either with the integral firing lever or with the antennous cable release, a single action only being required to both cock and fire the shutter. It is thus possible to fire the shutter remotely using a solenoid.

(NOTE: The standard solenoid A596 will not operate the ILEX SHUTTER).

1.2 FILM HOLDERS.

The following film holders are interchangeable and can be fitted to the back plate.

Polaroid 3¼ x 4¼ roll film holder - A 521.
Polaroid 3¼ x 4¼ pack film holder - A 524.

These are the simplest form of Polaroid film holders available with this camera, being adapted directly on to the camera back plate. They enable single exposures to be made with the film either in the vertical or horizontal configuration.

Polaroid 3¼ x 4¼ roll film holder - A 520.
Polaroid 3¼ x 4¼ pack film holder - A 523.

These film holders are used in conjunction with the slide plate assembly A 571 and enable multiple exposures to be made on one print, seven exposures in the horizontal and thirteen in the vertical configuration. These holders are fitted with a sheath which allows the assembly to be removed from the camera back plate without fogging the film.

M.P.P. International camera back - A 574.

This holder is also used in conjunction with A 571 and is designed to accept the following negative materials:-

4 x 5 Plates in 4 x 5 double plate holders.

4 x 5 Cut film in 4 x 5 double plate holders with cut film adaptors.

4 x 5 Cut film in 4 x 5 double film holders.
4 x 5 Cut film in American 'Grafmatic magazine.

9 cm. x 12 cm. Plates in continental single metal slides used with 9 cm. x 12 cm. adaptors.

9 cm. x 12 cm. Film in continental 9 cm. x 12 cm. film pack holders used with 9 cm. x 12 cm. adaptors.

3¼ x 4¼ Plates) in 4 x 5 double plate holders
3¼ x 4¼ Cut Film) with ¼ plate adaptors.

2¼ x 3¼ Film) in 120 roll film adaptor for
2¼ x 2¼ Film) 4 x 5 cameras.
Polaroid 4 x 5 Film packs Type 52, 57 and 55P/N in No.500 film holder.

1.3 VIEWING SYSTEM

Where direct viewing of the trace is required a binocular periscope is fitted. This is essentially a simple two mirror system which gives an upright image of the screen, i.e. not reversed. The lower mirror which is mounted within the camera body, is a beam splitter having a transmission/reflection ratio of approximately 3/1. The front surface has a reflective coating, the back surface being bloomed.

This treatment minimises multiple images due to reflection off the back surface, only very bright traces will give obtrusive double reflections. It is possible however to pivot the mirror out of the direct light path using the control on the left hand side of the body, so that all the usable light reaches the lens and none is lost through reflection. Do not handle the surfaces of this mirror.

A shutter is provided to exclude the light from the viewing tunnel. While viewing with this shutter open, the operator's head should provide an effective light seal in the moulded rubber face piece. It should not be necessary to remove spectacles, if they are of a standard pattern, while viewing.

NOTE: When it becomes necessary to clean the mirrors, use a special glass cleaning material such as "Selvyt" cloth. Do not rub hard. Do not use solvents or abrasives of any description.

1.4 ACCESSORIES

The body of the camera has a removable lower cover. It is possible to attach numbering counters, titling units or other data devices to this aperture, so that they are visible both through the periscope and to the lens by way of the mirrors.

1.5 OSCILLOSCOPE ADAPTORS

The camera is designed to be fitted to oscilloscopes having screens $3\frac{1}{2}$" to 5" diameter, and a range of adaptors is made to enable the camera to be used with most commercially available instruments of this size.

Special adaptors can be made to suit customers own requirements and it is possible to photograph larger or smaller screens by fitting special lens mounts.

Each adaptor presents a hinge, sealing surface and catch plate to the camera which can be readily attached or removed. It can also be hinged away to 90°. Do not load the catch more than necessary to just close the sealing surface otherwise the catch plate assembly may be overstressed.

SECTION 2

ASSEMBLY.

2.1 ASSEMBLY OF ADAPTOR TO OSCILLOSCOPE

Adaptor A 550 - Tektronix type.

Remove the four ring nuts holding the graticule cover, this cover is also removed and the adaptor fitted in its place, with the hinge sockets on the left hand side, and held in place with the four ring nuts. The adaptor will accommodate the standard graticules and light filters, although these filters are removed for fast photographic work. It may be necessary to remove any spacing washers from the studs before the adaptor is fitted in order that close contact is made between the panel and the adaptor. Ensure that all four nuts are tightened right down.

Adaptor A 551 - Cossor type..

For instruments having the graticule flush (or just under flush) with the camera mounting surface. Remove the viewing hood and affix the adaptor with the four 2 B.A. screws provided, with the hinge sockets on the left hand side.

Adaptor A 552 - Standard Bezel Ring.

Push the adaptor on to the bezel ring as far as it will go, with the hinge sockets on the left hand side, ensure that the hinge centre line is vertical before tightening the clamp screw.

The camera will now fit on to any of the above adaptors.

2.2 ASSEMBLY OF CAMERA.

Fit the main body of the camera on to the adaptor by means of the drop-in hinge. This hinge allows the camera body to be swung away from the oscilloscope to an angle of 90°. This angle is so limited in order to reduce the chance of interference with controls on the oscilloscope.

If the oscilloscope is being operated on a tilted stand, care should be taken when hinging the camera so that it does not swing down, as this is liable to damage both the oscilloscope and the camera.

Lock the body to the adaptor with the hook catch on the right hand side. Slacken the rack locking screws which are located on either side of the body near the focus control knobs, a coin slot is provided in the heads of these screws. Turn the focus control back to extend the back plate rack assembly to its limit. This assembly is now free but should not be removed from the body. Gentle pressure on the back plate will re-engage the focus rack gears.

Fit the lens to the back plate, ensuring that the location pin on the back plate is engaged in the groove in the lens mount. Screw on the lens locking ring and tighten with the spanner provided. Turn the focus control forward until the front of the lens hood enters the felt sealing ring in the body.

The camera back or slide plate holder will now fit into the backplate in either the horizontal or vertical configuration. Drop the flange on the camera back into the recess behind the retaining plate which is on the lower rim of the back plate. The flange will now enter the back plate providing the locking cam on the upper rim of the back plate is in the clear position, i.e. with the flat edge towards the centre of the back plate. Rotate the locking cam clockwise, looking at the coin slot, at the same time rotating the camera back to and fro about its approximate position in the back plate until the cam is felt to engage with the flange and lock it into the correct position. Continue turning the cam until the camera back is firmly held. The configuration can be changed to the other position by releasing the locking cam and rotating the camera back without removing it from the back plate.

WARNING: The locking cam must not be released unless the camera back is being held to prevent it falling free.

SECTION 3

OPERATION

3.1 FOCUSING.

Set the shutter to position 'T' and the iris to maximum aperture. Operate the shutter release to open the shutter blades. Using a steady display on the C.R.T. adjust the position of the focus control until a sharp image of the display is obtained on the focusing screen provided and lock up both clamp screws.

When using wide aperture lenses it is important to focus on the cathode ray tube trace and not on the graticule. The depth of focus in these lenses is insufficient to cover the distance between the graticule and the trace. The graticule can be superimposed by making a double exposure with the iris closed right down.

NOTE: If the trace cannot be focused within the limits of travel provided by the lens front tube, it must be concluded that either (a) the tube face is in a non standard position or (b) the wrong adaptor is being used. The dimension between the front face of the camera body and the C.R.T. trace is normally $1\frac{1}{2}$".

3.2 LOADING THE CAMERA

3.2.1. Polaroid Roll Film Type

Each Polaroid film roll is supplied in a sealed wrapper. The negative film is wound on to a plastic daylight loading spool and sealed, the positive paper is wound in a coil and sealed. Do not break these seals before loading the camera.

Open the back of the camera so that the lid hinges to the left, the inner partition and roller will now hinge to the right. Place the film spool in the right hand pocket and bring the leader across the film plane, place the paper roll in the left hand pocket.

Now close the inner partition and bring the leader across the camera to the right hand side, making sure that it runs between the two tabs on the back of the inner partition.

Close the main lid and operate the latch lever; the latch will not work correctly unless it is fully opened while the main lid is being closed. The end of the film leader should now appear under the cutter bar at the right hand side of the camera. Snap the red switch on the back of the camera, lift the cutter bar and pull the film leader through until it stops. This action breaks the seals on the rolls and the first picture is now ready for exposure.

3.2.2. Polaroid Pack Film Type

Open the camera back by releasing the catch which is under the lower right hand side of the camera. Remove the film pack from its protective sealed cover and insert into the back. Close the back and pull the tab which appears on the right hand side of the camera.
The camera is now ready for use.

3.3 EXPOSURE

The variable factors which govern the exposure of film in Oscilloscope cameras are so numerous that it is not possible to lay down hard and fast rules or even to use any form of simple light meter. The amount of photo-active light emitted from any one point on the trace is governed by, for example, beam current, spot size, focus, astigmatism, sweep speed and rise time as well as the colour and persistence of the phosphor.

The only practical way of determining the correct exposure is to take a series of test pictures, adjusting the controls until a satisfactory result is obtained.

However, there are three basic methods of approach which can be used according to the type and trace being recorded:

(a) Stationary wave.

Set the aperture as small as possible and adjust the length of exposure. This method allows the finest details to be recorded as the lens resolution and depth of focus are at a maximum. The trace must be steady to obtain the best results, but the effect of low frequency variations can be minimised by the use of fast films.

(b) Repetitive slow sweeps of the order 10-2 sec/cm.

Set the shutter to operate in a time just greater than the sweep time and adjust the lens aperture and/or trace brightness, to give the correct exposure.

(c) Single fast sweeps

In this case it is usual to leave the shutter open with the lens at maximum aperture and to trigger the oscilloscope to give a single sweep.

3.4 PROCESSING POLAROID ROLL FILM.

Snap the red switch in either direction. This releases the film so that the tab can be pulled through to develop the picture, at the same time advancing the film for the next picture.

Lift the cutter bar and, using a single action, maintain a direct firm pull until the film stops. If the tab will not pull, snap the switch again.

The development commences with the action of tab pulling and the recommended development time should be measured from that moment. After development release the door catch on the back of the Polaroid body and lift out the finished print.

If the print is to be kept as a permanent record it must be coated with the Polaroid Print Coater immediately, using six to eight strokes of the pad to cover the print entirely.

When using Polascope 410 film the film may be advanced at intervals of two seconds, the full ten seconds development taking place outside the film back.

3.5 PROCESSING POLAROID PACK FILM.

Pull the blue and white tab, now pull the second tab. This action removes the film from the camera and it develops in a minimum of 10 seconds. Peel the print from the negative and coat (as in 3.4)

Poloscope film is not available for the pack back.

SECTION 4

GENERAL NOTES ON OSCILLOGRAPHY

4.1 POLAROID PHOTOGRAPHIC MATERIALS

Three types of black and white positive roll film are available for use with the 3 x 4 Polaroid fast processing back:

Type 42 rated 200 A.S.A.

This is a slow film for general photography and is useful for recording stationary wave forms.

Type 47 rated 3,000 A.S.A.

A fast general purpose film capable of recording fast single sweeps.

Type 410 Polascope rate 10,000 A.S.A.

Especially devised for oscillography, this film has in fact more than twice the writing speed of the Type 47. It is not suitable for general pictorial work as the contrast is high. It is suitable for capturing the fastest sweeps generally used. It is supplied in cartons of 12 rolls.

Type 46L (1,000 A.S.A.) and 146L (200 A.S.A.) are also available. They provide a positive transparency suitable for immediate projection. A simple chemical dip is provided to complete the processing of these films.

Type 52 rated 200 A.S.A.

This film is similar to Type 42 but is used in the 4 x 5 processing holder.

Type 57 rated 3,000 A.S.A.

Similar to Type 47 but used in the 4 x 5 processing holder.

Type 55P/N rated 100 A.S.A.

It is possible to obtain both positives and negatives from this film which is used in the 4 x 5 processing holder.

Type 107 rated 3,000 A.S.A.

Similar to Type 47 but used in pack film back.

The use of Type 108 rated 75 A.S.A. Polacolour in Oscillography is probably limited and mention is made only to complete the list.

Further information and supplies may be obtained from:-

Telford Products Limited,
4, Wadsworth Road,
Greenford,
MIDDLESEX.

Telephone: ALPerton 1011 (S.T.D. 01-998 1011).

4.2 PRE-EXPOSING POLAROID FILM.

It is possible to increase the effective speed of most photographic negative materials by exposing them to small amounts of light prior to the working exposure. In simple terms, this pre-exposure takes up the 'backlash' in the chemical process and allows the working exposure to be fully effective.

To pre-expose Polaroid films use a 25 watt pearl bulb 9" behind a white diffusing screen. Now photograph this screen using the following exposures:-

Type 42,	200 A.S.A.	1/50 secs. @ f/5.6
Type 47, 107	3,000 A.S.A.	1/100 secs. @ f/11
Type 410,	10,000 A.S.A.	1/100 secs. @ f/22

These figures are only a guide, the user must make test exposure to ascertain the optimum conditions.

4.3 THE POLAROID TWO MINUTE TIMER, NO.120.

This is a small clockwork mechanism which gives out an audible signal for a predetermined length of time, up to two minutes. It can be used when making long exposures or for timing the development of film in the Polaroid processing backs. It is wound by the action of setting the pointer to the required time and started by pressing a push button. The fast escapement emits a buzzing sound.

It is intended only as a rough indicator of an elapsed time, not as an accurate time piece. It is not connected in any way to the camera shutter mechanism. Provision is made for attaching it to the body of the camera.

SECTION 5

ILLUMINATED NUMBERING DEVICE

5.1 General Description

The numbering device is attached to the underside of the 'A' camera body and, in conjunction with the parallax - free viewing periscope, enables the operator to see and record a 4 digit numerical display against each Oscilloscope trace. This display is reflected from a manually advanced mechanical counter and appears positioned on the centre line of the main oscilloscope graticule and at the right hand end of this line. In this way information relating to individual traces on a multiple exposure can be logged against a number. No interlocking mechanism between the camera shutter and the counter advance is provided. Hence, double exposures can be made or a series of traces can be taken against one reference number. The counter is not resettable. Low voltage illumination, controllable through a variable resistance, is provided by way of a built-in mains voltage transformer. The recorded height of the numerals at a lens ratio of 1:0.7 is approximately one tenth of an inch.

5.2 Setting Up

Remove the lower blanking plate from the main body of the 'A' camera. The device fits on to the same holes as the blanking plate and is mounted with the controls nearer to the film back. The mains supply should be 240V 50 cycles A.C. and be connected through the 3 pin plug and socket. The case of the device is connected to the earth pin.

5.3 Focusing

Focus the 'A' camera in the normal manner (see 3.1) and lock the rack adjustment, switch on the counter illumination and turn the brightness control to maximum. Loosen the knurled locking nut on the right hand side of the device. The nut can now be pushed forward or backward to adjust the position of the counter until a focused image is obtained on the screen in the camera film plane. The nut is tightened to lock the counter in position. A simple alternative method of focusing is by direct comparison through the periscope viewer, adjusting the position of the counter until it appears coincident with the C.R.T. trace.

5.4 Operation

5.4.1 Simultaneous Trace & Counter Recording

Having set the shutter and iris control to suit the brightness of the oscilloscope trace, switch on the counter illumination and adjust its brightness to match that of the trace when viewed through the periscope.

Press the shutter release, the trace and number will both be recorded on the film.

5.4.2 Separate Counter Recording

This can be made either before or after trace recording. Switch off trace, switch on counter illumination at its lowest level and press the shutter release. Switch off counter illumination.

Two typical exposure settings are:-

200 A.S.A. Film
Lens Aperture f/3.5
Exposure 1 sec.

3000 A.S.A. Film
Lens Aperture f/3.5
Exposure time 1/25 sec.

These values are given only as a guide and best results are obtained by adjustment over a series of test exposures.

5.5 Bulb Replacement

The counter is illuminated by a festoon lamp (6V.0.5A) which is accessible by demounting the device from the 'A' camera and removing the base plate. Spare bulbs are available from Telford Products Limited.

SECTION 6

ULTRA-VIOLET LIGHT SOURCE ATTACHMENT

6.1 General Description

The Ultra-Violet Light Source Attachment is used in conjunction with the Telford Camera Type 'A' mounted on an oscilloscope in which the measuring graticule is drawn on the inside of the cathode ray tube face plate. This arrangement obviates parallax errors and hence enables the oscilloscope to be accurately calibrated and interpreted both visually and photographically.

The cathode ray tube phosphor is caused to fluoresce by an ultra-violet exciter lamp within the camera body. This ultra-violet lamp is mounted behind a filter which is visually opaque but transmits wave lengths of the order 3650 A^{o}.

The level of illumination from fluorescence caused by the exciter lamp is less than that from phosphorescence caused by the cathode ray tube electron beam. This enables the trace to be easily visible against the graticule which is effectively at black level.

6.2 Construction

The unit consists of a mercury discharge lamp which is mounted in an air cooled housing on a metal plate. This metal plate fits the accessory panel opening in the under side of the Telford 'A' Camera body. Two mirrors are also mounted on this plate and these reflect U.V. light from the mercury lamp, via filters which eliminate visible radiation on to the C.R.T. screen.

The reason for this configuration of mirrors is to prevent direct reflection of U.V. into the lens or into the viewing system from the C.R.T. face plate.

6.3 Warning - U.V. Light

Even though the glass envelope of the lamp and the U.V. filters eliminate a high proportion of harmful radiation, it is not recommended to look directly at the U.V. lamp or into the front of the camera when the lamp is lit. Damage to unprotected eyes might be caused as the viewer is not aware of the high level of invisible illumination.

6.7 Operation

The U.V. lamp is used mainly for photographic recording of fast phenomena. The simplest method of operation is to make two exposures, the first being to record the graticule, and the second to record the trace. This method has the advantage that the film is pre-exposed and is effectively increased in sensitivity, thus enabling faster phenomena to be captured, single sweeps at speeds of 100 nancseconds/cm are recordable on 3000 A.S.A. film.

Exact values of graticule and trace exposure cannot be defined as individual conditions are subject to wide variation. Settings for any one set of conditions are best obtained by trial shots.

If the 'A' Camera is fitted with a parallax free viewer the lower mirror will absorb some of the U.V. light and prevent it reaching the C.R.T. screen. If it is essential to view the screen and the graticule during actual recording the Direct Viewer should be fitted in preference to the parallax free viewer, which is unnecessary in this application.

6.8 Technical Information

Lamp - Low pressure mercury discharge tube MAZDA Type M.2. Cat. No. 98 - 902. Arc wattage 4.5 (at 0.75 amps). Operating voltage AC 200-250 operating current 0.5 - 1.5 amps. Objective life 200 hours.

SECTION 7

PACKING, SERVICING AND GUARANTEE

7.1 Packing

The cameras are packed in fibre-board cases with a lining of honeycomb buffer board.

Individual parts, such as the lens and film holder, are separately boxed within the main pack.

Special carrying cases are available to order, price being dependent on particular requirements.

7.2 Servicing

A comprehensive range of parts is maintained by the makers and all queries and repairs should be sent to:-

The Service Department,
Telford Products Limited,
Wadsworth Road, Perivale,
Greenford, Middlesex.
England.

Telephone: 01-998-1011

Telex : 935524

Cables : Davall, Southall.

7.3 Guarantee

The camera is guaranteed against failure arising through faulty workmanship or materials for a period of twelve months from the date of delivery, during which period any defective part will be replaced or repaired free of charge.

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